2016 Annual Survey of Public Employment & Payroll Methodology

The U.S. Census Bureau sponsors and conducts this annual survey of state and local governments as authorized by Title 13, United States Code, Sections 161 and 182.

The survey measures the number of state and local civilian government employees and their gross payrolls for the pay period including March 12, 2016.

Population of Interest

The population of interest for this survey includes all agencies of the 50 state governments, and 90,056 local governments (i.e., counties, municipalities, townships, special districts, and school districts) including the District of Columbia.

Content of the Survey

The survey provides state and local government data on full-time and part-time employment, part-time hours worked, full-time equivalent employment, and payroll statistics by governmental function (i.e., elementary and secondary education, higher education, police protection, fire protection, financial administration, central staff services, judicial and legal, highways, public welfare, solid waste management, sewerage, parks and recreation, health, hospitals, water supply, electric power, gas supply, transit, natural resources, correction, libraries, air transportation, water transport and terminals, other education, state liquor stores, social insurance administration, and housing and community development).

The questionnaires that were used to collect these data can be viewed at <GET FORMS> on the Survey of Public Employment & Payroll Website.

Critical definitions include the following:

Employment: Employment refers to all persons gainfully employed by, and performing services for, a government.

Employees: State and local government employees include all persons paid for personal services performed, including persons paid from federally funded programs, paid elected or appointed officials, persons in a paid leave status, and persons paid on a per meeting, annual, semiannual, or quarterly basis. Unpaid officials, pensioners, persons whose work is performed on a fee basis, and contractors and their employees are excluded from the count of employees.

Full-time employees: Full-time employees are defined to include those persons whose hours of work represent full-time employment in their employing government.

Part-time employees: Part-time employees are those persons who work less than the standard number of hours for full-time work in their employing government.

Full-time equivalent: Full-time equivalent (FTE) is a computed statistic representing the number of full-time employees that could have been employed if the reported number of hours worked by part-time employees had been worked by full-time employees. This statistic is calculated separately for each function of a government by dividing the "part-time hours paid" by the standard number of hours for full-time employees in the particular government and then adding the resulting quotient to the number of full-time employees.

Payroll: Payroll amounts represent gross payrolls for the 1-month period of March (31 days). The gross payroll includes all salaries, wages, fees, commissions, bonuses, or awards paid to employees during the pay period that includes the date of March 12. Payroll amounts reported for a period other than 1-month are converted to represent an amount for the month of March. All payroll figures are represented in current whole dollars and have not been adjusted for inflation.

Conversion of a reported payroll to a payroll amount that would have been paid during a 31-day month is accomplished by multiplying the reported payroll by an appropriate factor. For example, a 2-week payroll is multiplied by the ratio of 31/14, a 1-week payroll is multiplied by the ratio of 31/7, and a twice-a-month payroll is multiplied by 2.

Part-time hours: These data represent the number of hours worked by part-time employees during the pay period. These data are used to calculate full-time equivalent employment data.

Data Collection

Confidentiality
The data that are collected in this survey are public record and are not confidential[1].

Dates of Collection
The following are important dates in the data collection process:

03/2016	Initial mail-out
04/2016	Reminder letter mail-out
06/2016	Follow-up mail-out

[1] Title 13, United States Code, Section 9(b).

Methods

Data in these files are based on information obtained in the Annual Survey of Public Employment & Payroll. 44 of the state governments provided data from central payroll records for all or most of their agencies/institutions. Data for agencies and institutions for the remaining state governments were obtained by mail canvass questionnaires. Local governments were also canvassed using a mail questionnaire. However, elementary and secondary school system data in Delaware, Florida, and North Dakota were supplied by special arrangements with the state government in each of these states. All respondents had the option of completing the survey using a web-based survey instrument developed for reporting the data. The online survey instrument was completed by 33.4 percent of the state-level responding units and 95.3 percent of the local government respondents.

Sample Design

The 2016 Annual Survey of Public Employment & Payroll consists of the 50 state governments and a sample of local governments. The sample of local governments was selected from the 2012 Census of Governments, Survey of Public Employment & Payroll and was updated annually with births (units that did not exist in 2012). A two-stage sample was designed to produce state-by-type of government estimates with a relative standard error of three percent or less for FTE employees and total payroll at the national level. In the first stage, the sample design is stratified probability proportional to size (PPS) of the local governments. In the second stage, a modified cut-off sample method was used to reduce the number of small townships and special districts included in the final sample. At the time of sample selection, there were 90,056 local governments on the sampling frame.

Prior to sample selection, the sampling frame was stratified by state and type of government (county, city, township, special district, school district). For special districts, the sampling frame was sorted by function code within strata. (Note: See Chapter 12 of the <2006 Classification Manual> for the categories for classifying Employment data.)

Prior to the 2016 mail-out, the sampling frame was updated with newly discovered births and deaths. All city, county, township, special district, and school district births were added to the sample as certainties with a probability of selection of 1.0000. Deaths were removed from the sampling frame and weights of the affected cells or strata were adjusted for sampled units within strata.

Weighting

The weight for each unit in the sample is the reciprocal of that unit's probability of being selected into the sample. The weight was obtained by the PPS sampling method or modified cut-off sampling method depending on whether the unit was in the cut-off subset or not. The value of total payroll was used as the unit's measure of size.

Sample size
The 2016 sample contains 10,577 state and local governments. Of the total number of local governments in the sample, approximately 13.6 percent are counties, 33.6 percent are cities and townships, 29.5 percent are special districts, and 23.3 percent are school districts. All 50 state governments, all Hawaii local units, and the District of Columbia are certainty units with a weight of 1.0.

Data Processing

Editing
Editing is a process that tries to ensure the accuracy, completeness, and consistency of survey data. Efforts are made at all phases of collection, processing, and tabulation to minimize reporting, keying, and processing errors.

Although some edits are built into the Internet data collection instrument and the data entry programs, the majority of the edits are performed post collection. Edits consist primarily of two types: (1) *consistency edits* and (2) *ratio edits*.

The *consistency edits* check the logical relationships of data items reported on the form. For example, if a value exists for employees for a function then a value must exist for payroll also. If part-time employees and payroll are reported then part-time hours must be reported and vice versa.

For each function reported for the employees, the *ratio edits* compare data for the number of employees and the average salary between reporting years. If data fall outside of acceptable tolerance levels, the item is flagged for review.

For *consistency edits* and *ratio edits*, the edit results are reviewed by analysts and adjusted as needed. When the analyst is unable to resolve or accept the edit failure, contact is made with the respondent to verify or correct the reported data.

Imputation
Not all respondents answer every item on the questionnaire. There are also questionnaires that are not returned despite efforts to gain a response. Imputation is the process of filling in missing or invalid data with reasonable values in order to have a complete data set for estimating state and national totals.

For nonresponding general purpose governments, dependent and independent school districts, and for special district governments, the imputations were based on recent historical data from the prior year annual survey. These data were adjusted by a growth rate that was determined by the growth of responding units that were similar (in size, geography, and type of government) to the nonrespondent. If there were no recent historical data available, the imputations were based on the data from a randomly selected responding donor that was similar (based on the same criteria) to the nonrespondent. For general purpose

governments, and for dependent and independent school districts, the selected donor's data were adjusted by dividing each data item by the population (or enrollment) of the donor and multiplying the result by the nonrespondent's population (or enrollment).

Estimation

Estimation is the process by which sample data are used to project the value of an unknown quantity in a population. In the publications for employment statistics, total full-time employment, total full-time payroll, total full-time equivalent employment, total part-time employment, total part-time payroll, total part-time hours, and their coefficients of variation are published. Estimates of totals are calculated for each state-by-function "cell" (e.g., Corrections for Minnesota). To calculate estimates at such a detailed level, small area estimation is used. We employed a hybrid approach - a combination of various estimation methods. Hybrid estimates can be obtained from the 2016 sample data and data from the 2012 Census of Governments, Survey of Public Employment & Payroll.

There are three methods in the hybrid approach. First, the Horvitz-Thompson (HT) estimator is a weighted sum of the sample data. Intuitively, each unit in the sample represents itself and possibly many other units. To calculate the HT estimate, each data point in the sample is multiplied by its sampling weight, and then these values are summed over the corresponding area of interest. Second, the Empirical Best Linear Unbiased Prediction (EBLUP) estimator is used with a robust estimation approach that includes 2012 data as covariates. Third, the synthetic estimator is based on a Decision-Based estimator of the state total and the assumption that employment in 2016 is proportional to employment in 2012 for the same state and function. The synthetic estimator is used when the cell has missing or no data. See the "For Further Information" section for papers related to these three estimation methods.

These methods have different tradeoffs. The HT estimator is unbiased, but it has high variability. The model-based EBLUP estimator could be biased, but it often performs very well, especially when the underlying model is justified, or even when the model is wrong but in a big cell the model converges to the HT estimator. Similarly, the synthetic estimator can have a large bias, but it often has lower variance than that of the HT estimator and can be used even if no sample data are available for the cell.

Sampling Variability

The data that are provided come from a sample rather than a census of all possible units. The particular sample that was selected is one of a large number of possible samples of the same size and sample design that could have been selected. A different sample would have yielded different estimates. The estimated coefficient of variation, which is provided for each estimate, is an estimate of the sampling variability. In this tabulation, the coefficients of variation are expressed as percentages. The coefficient of variation (CV) is the ratio of the

standard error to the expectation of the estimate. We used a Taylor series method, or the estimate of the posterior distributions, to estimate the standard errors.

State government employment and payroll data are not subject to sampling error. Consequently, state and local government estimates for individual states are more reliable statistically than the local government only estimates.

Data Quality

Nonsampling Errors

Although every effort (as described in the Data Processing section) is made in all phases of collection, processing, and tabulation to minimize errors, the sample data are subject to nonsampling errors (such as, inability to obtain data for every variable from all units in the sample, inaccuracies in classification, response errors, misinterpretation of questions, mistakes in keying and coding, and coverage errors). These same errors may be evident in census collections and may affect the Census of Governments data used to adjust the sample during the estimation phase and used in the imputation process.

Modal Distribution

Each respondent that received a questionnaire had the option of reporting data using a website developed for reporting data electronically, or working directly with staff members to report over the phone, fax or email. In addition, some governments have developed alternative reporting arrangements, known as central collection. The following table shows the response rate by mode for state and local governments that reported to the 2016 Annual Survey of Public Employment & Payroll.

	State Governments	Local Governments
Web	33.4%	95.3%
Central Collection	65.7%	1.1%
Other	0.9%	3.6%

Overall Unit Response Rate

The overall unit response rate to the 2016 Annual Survey of Public Employment & Payroll was 79.2 percent. All unit response rates are well above the 60 percent Census Bureau's quality standard. The key variables for the survey are total employment and total payroll. The unit response rate was calculated for each state as well as for the total U.S., and gives the percentage of the units in the eligible universe that actually responded to the survey.

For 2016, weighted response rates are published for each item. This rate is calculated by dividing the weighted value of the item as reported by respondents

by the weighted value of the item reported for respondents and imputations for nonrespondents.

Total Quantity Response Rate

The Total Quantity Response Rate (TQRR) was also calculated for the key variables for each state. The key variables for the survey are total employment and total payroll. This response rate is computed separately for each key variable by summing the data provided by the respondents for the key variable and dividing this sum by the sum of the respondent data and the imputed data for the key variable. The result is multiplied by 100. Files of the unit response rates and TQRR's for all states are available in the Response Rate Tabulations section below.

The Census Bureau's quality standard on releasing data products requires a 70 percent TQRR for the key variable estimates. However, we found noncompliance of the standard at all three levels of estimates produced:

For the combined state and local governments estimates, eight states (Louisiana, Minnesota, Mississippi, Nebraska, New Jersey, Tennessee, Vermont, and Washington) failed to meet the 70 percent TQRR standard for at least one of the combined estimates for the key variables (total employment and total payroll).

For the state governments, there are nine states (Maine, Maryland, Minnesota, Nebraska, Nevada, New Jersey, North Carolina, Oregon, and Tennessee) that are noncompliant with the TQRR standard for at least one of the state government's key variables.

For the local estimates, there are 12 states (Colorado, Connecticut, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, New Hampshire, Rhode Island, Vermont, Washington, and Wisconsin) that are noncompliant with the TQRR standard for at least one of the local government's key variables.

Response Rate Tabulations

State Government Response Rates [TXT, 4KB] – Unit and Total Employment and Payroll Response Rates by state for state governments.

Local Response Rates [TXT, 4KB] – Unit and Total Employment and Payroll Response Rates by state for local governments.

State & Local Government Response Rates [TXT, 4KB] – Unit Total Employment and Payroll Response by state for state and local governments combined.

Response Rate Notice for the 2016 Annual Survey of Public Employment & Payroll - (Please read this notice concerning the Government Response Rates) – [PDF, 104KB]

For Further Information:

Barth, Joseph, Yang Cheng, and Carma Hogue. "Reducing the Public Employment Survey Sample Size," Joint Statistical Meetings, 2009

Cheng, Yang, Casey Corcoran, Joseph Barth, and Carma Hogue. "An Estimation Procedure for the New Employment Survey Design," Joint Statistical Meetings, 2009

Cheng, Yang, Eric Slud, and Carma Hogue. "Variance Estimation for Decision-Based Estimators with Application to the Annual Survey of Public Employment and Payroll," Joint Statistical Meetings, 2010

Tran, Bac and Brian Dumbacher. "An Evaluation of Different Small Area Estimators for the Annual Survey of Public Employment and Payroll," Joint Statistical Meetings, 2014

Tran, Bac and Yang Cheng. "Application of Small Area Estimation for Annual Survey of Employment and Payroll," Joint Statistical Meetings, 2011